EXHIBIT 1

United States Department of Agriculture

Habitat Mapping Documentation for Canada Lynx (*Lynx canadensis*) on the Beaverhead-Deerlodge National Forest – 2020 Update

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Key Abbreviations

BARC: Burned Area Reflectance Classification

BDNF: Beaverhead-Deerlodge National Forest

ESI: early stand initiation

FEIS: Final Environmental Impact Statement

LAU: lynx analysis unit

LCAS: Lynx Conservation Assessment and Strategy

MMS: mature; multi-storied

MTBS: Monitoring Trends in Burn Severity

NRLMD: Northern Rockies Lynx Management Direction

PVT: potential vegetation types

SE: stem exclusion

SI: stand initiation

SNODAS: Snow Data Assimilation System

VMap: Northern Region Existing Vegetation Mapping program

Introduction

This document describes the process used to update geospatial layers and lynx analysis units (LAUs) for Canada lynx on the Beaverhead-Deerlodge National Forest[8] ("Forest" or BDNF). This process follows mapping guidelines in the LCAS (Reudiger et al. 2000), the NRLMD (USDA Forest Service 2007), the Regional Forester's Memo (Marten 2016), and meets LAU Standard 1 outlined in the Record of Decision for the NRLMD (USDA Forest Service 2007) using improved vegetation datasets, habitat information, and remote sensing tools. In addition, Eastside Forests in Montana worked with the Regional Office to develop a consistent way to model and create a map product that supports both broad-scale and project-level analyses for lynx (USDA Forest Service 2016). This guidance developed rule sets that utilized available data to best identify and predict lynx habitat and vegetation structural stages.

The following direction guided this process:

- Information and direction contained in the original Canada Lynx Conversation Assessment and Strategy (LCAS; Reudiger et al. 2000);
- Northern Rockies Lynx Management Direction (NRLMD; USDA Forest Service 2007);
- Potential vegetation type (PVT) classification for the Northern Region (USDA Forest Service 2004);
- Guidance and direction provided in the 2016 Regional Forester's memo for clarification of lynx habitat mapping (Marten 2016); and
- Region 1 Vegetation Mapping Program (VMap) classification for the Beaverhead-Deerlodge National Forest (Ahl et al. 2018).

In 2019, the Forest began to update the previous habitat maps using this guidance and produced a geospatial map layer of lynx habitat and lynx analysis units for the BDNF. The resulting map products (Appendix B) identify updated "mapped lynx habitat", including LAUs and vegetation structural stages.

Previous Lynx Habitat Mapping

In 2001, the Beaverhead-Deerlodge National Forest estimated lynx habitat and delineated associated LAUs using the best available vegetation datasets at the time.

Data Sources and Assumptions

At that time, the BDNF did not have a consistent habitat mapping method but determined the best data source combined two existing geospatial products: remotely-sensed satellite imagery (SILC-3) and aspect from 30-meter digital elevation models (DEMs). Satellite imagery land classification, version 3 (SILC-3) delineates existing vegetation attributes (cover type) across the entire landscape, and, when combined with aspect from the DEMs, created a surrogate for habitat types that represented potentially suitable habitat for Canada lynx. Using this guidance, the Forest

[8] The Helena-Lewis and Clark National Forest jointly administers the Elkhorn portion with the BDNF. The Helena-Lewis and Clark identified and mapped lynx habitat and associated LAUs within the Elkhorn Mountain Range in a separate process paper (USDA Forest Service 2020). This document does not address the Elkhorn landscape.

used attributes from existing vegetation datasets, namely subalpine fir, spruce, and cool-moist Douglas-fir habitat types, to identify lynx habitat.

Lynx Habitat

Rationale

The Canada lynx was listed as threatened in March of 2000. As a result, the Forest Service agreed to identify and map lynx habitat and lynx analysis units within the National Forest System per the Lynx Conservation Agreement (USDA Forest Service & USDI Fish and Wildlife Service 2000) between the U.S. Forest Service and the U.S. Fish and Wildlife Service. The LCAS (Reudiger et al. 2000) served as the basis for describing habitat for mapping activities.

Process

Biologists and silviculturists determined the cover type and aspect combinations (Table 1) that likely incorporated desirable snowshoe hare habitat based on existing seral vegetation stage and moisture. Subject matter experts expected this method overestimated lynx habitat acres due to the lack of data specific to the habitat types most preferred by lynx. However, this conservative approach was accepted as the best available means of mapping lynx habitat on the Forest at the time. This process resulted in 2,711,422 acres of lynx habitat on the Beaverhead-Deerlodge National Forest.

Table 1. Cover type and aspect combinations used to map lynx habitat in 2001.

SILC-3 Cover Type	Aspect
4101 aspen	all
4102 broadleaf forest	all
4201 Engelmann spruce	all
4203 lodgepole pine	all
4208 subalpine fir	all
4212 Douglas-fir	northeast, north, northwest, flat
4219 alpine forest	all
4220 mixed subalpine forest	all
4221 mixed mesic forest	all
4223 Douglas-fir/lodgepole pine	northeast, north, northwest, flat
4224 burned timber stands	all
4225 Douglas-fir/grand fir	all
4229 western larch/Douglas-fir	northeast, north, northwest, flat
4301 mixed forest	all
6101 needleleaf-dominated riparian	all
6102 broadleaf-dominated riparian	all
6103 needleleaf/broadleaf riparian	all
6104 mixed riparian	all
6202 shrub riparian	all
6203 mixed non-forest riparian	all

Lynx Analysis Units

Rationale

Identifying lynx analysis units were another requirement of the Conservation Agreement (USDA Forest Service & USDI Fish and Wildlife Service 2000). Lynx analysis units provide a scale to begin the analysis of potential direct and indirect effects of projects or activities on individual lynx (Ruediger et al. 2000). In general, LAUs should approximate the size of a female lynx annual home range (25-50 square miles or 15,000-30,000 acres) and each LAU should incorporate a minimum of 10 square miles of primary vegetation that includes alpine forest or Engelmann spruce forest habitat types (Ruediger et al. 2000; USDA Forest Service 2007). Hydrologic Unit Codes (HUCs)[9] serve as the starting point to delineate LAUs (Ruediger et al. 2000).

Process

The Forest developed the following steps to identify LAUs:

1. Start with the entire boundary of all 6th code HUCs[10] within the southwest Montana extent that contains the Beaverhead-Deerlodge National Forest.
2. Remove HUCs that do not contain lynx habitat.
3. Trim portions of HUCs that do not contain or are not adjacent to lynx habitat.
4. Split and combine remaining HUCs into appropriately sized polygons to meet the contiguous habitat criteria, as described by Ruediger et al. (2000).

After identifying 2.7 million acres of lynx habitat, the BDNF began the initial LAU mapping process using 6th code HUCs as the starting point. However, additional refinement beyond the first step was not completed per direction during that time.

This resulted in 509 LAUs that contained a range of 0 – 24,101 acres of lynx habitat per LAU. 118 LAUs had 0 acres of mapped lynx habitat and 208 LAUs contained less than 6,000 acres, which does not meet the minimum life history requirements of a female lynx or the LCAS mapping recommendation for incorporating at least 6,400 acres of primary vegetation per LAU.

Consequently, the currently mapped LAU boundaries do not accurately represent the appropriate scale to analyze potential direct and indirect effects of projects or activities on individual lynx as intended and required by the NRLMD. As such, the Forest determined the LAU process should be completed to support more accurate project and activity effects analysis.

Updated Lynx Habitat Mapping

Methods outlined in this section incorporate the best available scientific information concerning lynx populations, distribution, habitat use, and prey species to generate an updated habitat model,

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[9] Hydroloic Unit Codes (HUCs) describe the contributing drainage area of a stream from large scale "regions" down to small scale "subwatersheds".
[10] 6th code HUCs are at the subwatershed level, which subdivides a watershed into respective drainage parts.

associated LAUs, and structural stage classification. This update incorporates new information and delineates appropriately sized LAUs.

Data Sources and Assumptions

Data and associated assumptions used to generate the updated lynx habitat model, structural stages, and LAUs are described below:

VMap, Version 18

VMap, a spatial database derived from remote-sensing landscapes, classifies existing vegetation and contains attributes including life form, dominance type, tree canopy cover class, and tree size class based on the Region 1 existing vegetation classification system. The base imagery is 10-meter resolution, but pixels are aggregated into smoothed polygons based on similarity of vegetation within a given area. Size of polygons range from 2 to 10 acres with no minimum or maximum size limitations. This allows for an accurate spatial depiction of vegetation pattern across the landscape. An accuracy assessment supports each attribute which provides a quantified estimate of the error associated with each mapped class. Due to its accuracy, VMap-18 polygons were used as the base mapping units and starting point to identify lynx habitat.

Potential Vegetation Types (PVT)

Potential vegetation types (PVT) consist of broad habitat type groups. PVT describes the type of habitat that may be present on the landscape based on an aggregation of plant communities of similar biophysical characteristics and similar function and response to disturbances. For example, areas with cool and wet characteristics may be assigned to the “abla1” (subalpine fir) habitat type. PVT was assigned to the base VMAP polygons using FSVeg data where available, and Jones PVT where FSVeg was unavailable.

FSVeg

FSVeg is a vegetation database composed of vegetation condition data on National Forest System lands. Data sources that contribute to this database include on-the-ground site visits (e.g. common stand exams), aerial photo interpretation, and extrapolation of vegetation information from neighboring stands. Information on habitat type (Pfister et al. 1997), where available, was the only attribute from FSVeg used in this analysis. FSVeg is assumed to be the most accurate dataset for determining habitat type because data are obtained from actual field visits and data extrapolation is completed by local, field-going personnel. However, border-to-border FSVeg data does not exist on the BDNF and only occurs where suitable timber exists on the landscape. Areas that do not have FSVeg data include wilderness and roadless areas, private lands, and newly acquired National Forest System lands.

Jones PVT

Jones PVT (2004) covers all of Region 1 as a contiguous, 90-meter raster of unknown accuracy. It uses point locations of known habitat types, and anecdotal reviews suggest it provides good estimations at broad scales but contains errors at finer scales and site-specific locations.

Regeneration Disturbance

Disturbance layers used in this process include regeneration timber management activities, high and moderate severity wildfire, and other disturbance processes such as insects and disease and

windthrow. The Forest used disturbance layers to filter potential erroneous habitat type assignments and to classify structural stages. Specific data included the following:

Timber management disturbance
Regeneration activities, queried from the Forest Activity Tracking System (FACTS) database, generally utilizes timber stands which average 40 acres in size. Structural stages within the 40-acre plots may differ because a management activity may affect only a portion of the stand, which causes an over-representation of actual disturbance. For example, "patch clearcut" may only occur within a single stand within the 40-acre polygon, although the regeneration treatment applies to the entire acreage.

Wildfire disturbance
Fire severity data from both the Burned Area Reflectance Classification (BARC) and Monitoring Trends in Burn Severity (MTBS) was used in this process. The BARC database, the primary source for fire severity, contains a satellite-derived data set of post-fire vegetation condition ranked from low severity to high. MTBS, the secondary source for fire severity data, consists of a 30-meter remote-sensing derived raster produced using Landsat TM imagery and is available for fires greater than 1000 acres, post-1984. This product is produced without field validation or an accuracy assessment. When fire severity data is lacking, external fire perimeters are used to indicate disturbance and are assigned an "unknown" severity.

Other disturbances
The updated mapping effort also considered other regeneration disturbances where mapped or otherwise identified. These include timber harvest on non-Forest Service owned lands, insect-cause mortality at severities sufficient to reset stands to regeneration (primarily mountain pine bark beetle and Douglas-fir bark beetle), and any other identified source, such as wind, flood, or other damage.

Snow Data Assimilation System (SNOWDAS)

The NOAA National Weather Serve's National Operational Hydrologic Remote Sensing Center Snow Data Assimilation System contributes to this dataset and consists of snowpack properties, such as depth and snow water equivalent. SNODAS was developed to provide the best possible estimates of snow cover and associated parameters to support hydrologic modeling and analysis.

Biophysical Attributes

Measures of elevation, aspect, and slope are included in VMap data. Results of studies conducted on lynx habitat use during winter in northwest Montana (Squires et al. 2010) provided empirical data for establishing snow depths that provide a competitive advantage over other meso-carnivores during winter, and development of corresponding lower elevational thresholds for mapping lynx habitat (refer to the mapping process descriptions). Due to the diverse landscape on the BDNF, the elevation where snow depth met the minimum requirement varied by location. Aspect was used for structural stage classification to further inform the lynx habitat model.

Lynx Habitat

Rationale

The process described in this document for updating lynx habitat is consistent with Appendix B in the NRLMD (USDA Forest Service 2007), the NRLMD Biological Opinion (USDI Fish and Wildlife Service 2007), the LCAS (Ruediger et al. 2000), and the memo on Clarification on Lynx Habitat Mapping in Region 1 (Marten 2016). Mapping updates such as this were anticipated in the final environmental impact statement, record of decision, and biological opinion for the NRLMD as indicated in the following statements:

- Lynx habitat maps (and lynx analysis units) would be refined and updated as new information and improved GIS mapping techniques become available (USDI Fish and Wildlife Service 2007); and
- Map vegetation that could contribute to lynx habitat, as described for each geographic area in the Lynx Conservation Assessment and Strategy, using the finest-scale vegetation information that is available (USDA Forest Service 2007).

This update used geospatial data that could contribute to lynx habitat (as described for each geographic area in the 2000 LCAS) using the finest-scale vegetation information available (USDA Forest Service 2016) to map primary and secondary vegetation. Primary vegetation is composed of subalpine fir habitat types dominated by cover types of spruce/fir, Douglas-fir, and seral lodgepole pine that support foraging, denning, and young-rearing (USDA Forest Service 2016). Secondary vegetation consists of other cool, moist habitat types (e.g., Douglas-fir, grand fir) that may contribute to lynx habitat where intermingled and immediately adjacent to primary vegetation (USDA Forest Service 2016). Note that a habitat type is an aggregation of plant communities of similar biophysical characteristics and similar function and response to disturbances whereas a cover type is the vegetation composition of an area, as described by the dominant plant species.

In addition to existing vegetation data, a snow-depth filter improved the model. Habitats with deep, fluffy snow give lynx a competitive advantage over animals that do not have large feet adapted for over-snow travel, such as bobcats, mountain lions, and coyotes (Ruggiero et al. 1999).

Process

VMap-18 vegetation polygons were used as the base mapping units for identifying lynx habitat. The polygons are attributed with existing vegetation information (such as cover type, size class, and canopy cover) and biophysical setting data (aspect and elevation) that are used in the modeling process to classify lynx habitat. When additional attributes from other data sources are utilized, such as habitat type and disturbance data, a zonal majority spatial update process assigns these additional attributes to the existing VMap-18 polygons. This process maintains the VMap-18 polygons as the base mapping units.

The stepwise process for determining lynx habitat on the landscape is outlined below:

1. Starting with VMap-18 data, polygons labeled with an existing cover type of “urban” or “water” were re-classified into non-habitat and were removed from further analysis.

2. The remaining polygons were assigned a Potential Vegetation Type (PVT). PVT was assigned via a crosswalk (Milburn et al. 2015) based on FSVeg habitat types defined in *Forest Habitat types of Montana* (Pfister et al. 1977). Where FSVeg data was not available, PVT was assigned using SILC3 PVT (Jones 2004).
3. VMap polygons assigned subalpine fir and Engelmann spruce potential vegetation types (abla1, abla2, abla3, abla4, abla5, and picea) were classified as *preliminary primary vegetation* habitat.
4. All VMap polygons assigned moist Douglas-fir and Grand fir potential vegetation types (psme2, abgr2, abgr3) were classified as *preliminary secondary vegetation* habitat.
5. All remaining VMap polygons were classified as non-habitat and were removed from further analysis.
6. *Preliminary* habitat polygons (consisting of both primary and secondary vegetation as identified in steps 3 and 4, respectively) were checked for PVT classification errors. The assigned PVT may be an error where a VMAP polygon labeled with a non-tree cover type (i.e., shrub, grass, or non-vegetated) was assigned a forested PVT type. This combination of a forested PVT assigned to a polygon with a non-tree cover type occurs for one of two reasons:
   a. a disturbance on the landscape "reset" the cover type to an earlier regeneration phase; or
   b. the polygon was assigned an inaccurate potential vegetation type from the Jones' PVT data source.

   Polygons with non-tree cover type attributes were compared to known regeneration disturbance layers (timber management, wildfire, and other disturbances). Non-tree polygons that overlapped with a disturbance were retained as preliminary habitat. Non-tree polygons that did not overlap with disturbances were deemed to be erroneously assigned a forested habitat type and were thus classified as non-habitat and removed from further analysis.
7. A snow-depth elevation filter (Klein-Baer et al. 2019) further refined the preliminary habitat. Areas with deep, fluffy snow provide a competitive advantage for lynx during winter. Telemetry studies in northwest Montana indicated that lynx selected habitats with a minimum snow depth of 50 centimeters (Squires et al. 2010). For each 5th code (HUC10) watershed on the BDNF, average snow depths (obtained from SNOWDAS) greater than 50 centimeters from December to May 2009-2019 were used to determine the lower threshold elevation for habitat. BDNF personnel with site-specific knowledge of winter conditions on the landscape reviewed the modeled threshold elevations for each HUC10 watershed. In watersheds where the modeled threshold elevation was not consistent with local observation of snow depth (Table 2), site visits determined the corrected threshold elevation value. Preliminary habitat polygons falling below the validated 50-centimeter snow depth threshold elevation within each HUC10 watershed were reclassified as non-habitat and removed from further analysis.

Table 2. Watersheds where habitat polygons were changed to reflect ground-verified snow elevations.

Landscape	Area Description	Watershed Name	Watershed HUC
Bighole	Fishtrap/La Marche/Seymour	North Fork Bighole River	100200405
		Christiansen Creek–Bighole River	1002000406

Landscape	Area Description	Watershed Name	Watershed HUC
		Deep Creek	1002000407
		Fishtrap Creek-Bighole River	1002000408
Jefferson River	Highlands	Big Pipestone Creek	1002000502
		Middle Jefferson River	1002000505
		Upper Jefferson River	1002000501
Gravellys	West Fork Madison	Lake Creek	1002000705
		West Fork Madison	1002000706

8. A 300 meter proximity filter was applied to refine secondary vegetation. If any part of a preliminary secondary vegetation polygon was within 300 meters of a primary vegetation polygon, the entire secondary vegetation polygon was retained as secondary vegetation that contributes to lynx habitat. Retaining the entire polygon where any portion was within 300 meters of primary vegetation resulted in retaining secondary vegetation polygons, extending from 0 to approximately 600 meters away from primary vegetation polygons (Figure 1). 600 meters is consistent with research for snowshoe hares using secondary vegetation proximal to primary vegetation habitat (Lewis et al. 2011). Secondary vegetation polygons located (in their entirety) more than 300 meters from primary vegetation polygons were reclassified as non-habitat and removed from further analysis.

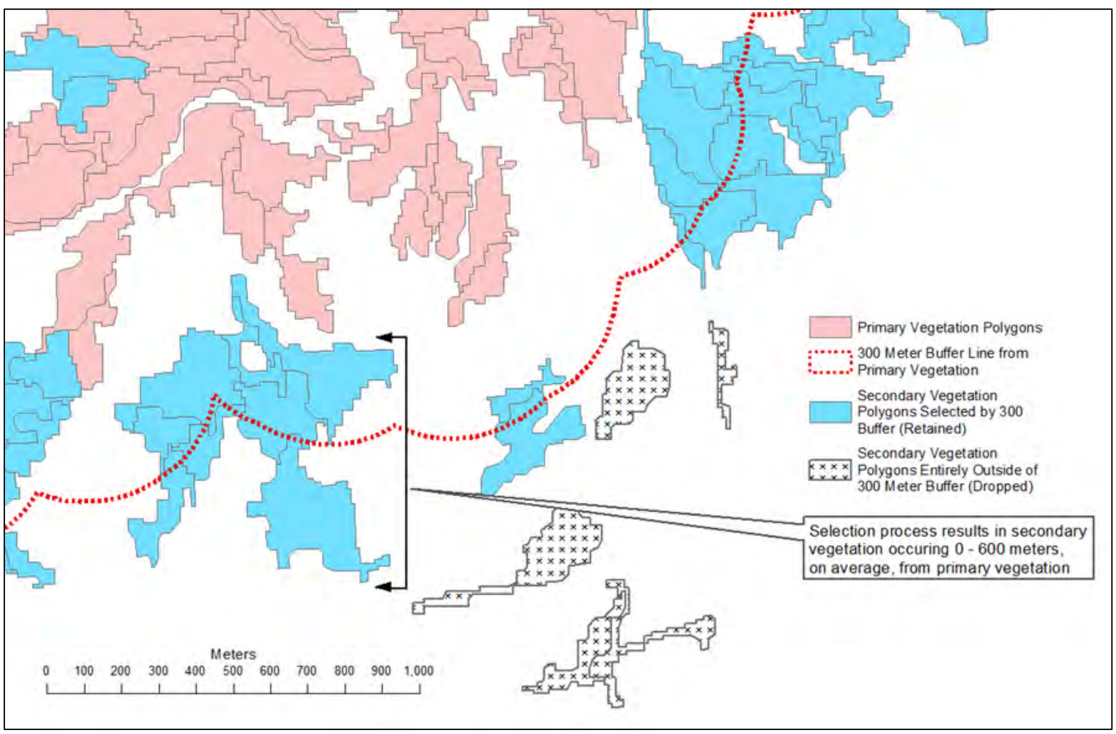

Figure 1. Example of refining secondary vegetation polygons within a 300 meter buffer from primary vegetation polygons.

9. All remaining habitat was carried forward into the lynx analysis unit delineation process.

Lynx Analysis Units

Rationale

The NRLMD includes a standard that directs the appropriate process for changing lynx analysis unit boundaries because delineated lynx habitat was likely to change over time as a result of lynx habitat mapping updates that incorporated improved vegetation data sets. This standard (LAU S1) states: "Changes in LAU boundaries shall be based on site-specific habitat information and after review by the Forest Service Regional Office" (Standard 1, USDA Forest Service 2007). For this reason, LAUs previously delineated in 2000 were not utilized as part of this process because: 1) the vegetation data sources are outdated; 2) the LAUs were based on 6th code HUCs that are relatively small and incapable of incorporating enough lynx habitat to support a female lynx home range; and 3) the LAUs incorporated entire watersheds that included lower elevations that encompassed vegetation types that do not provide habitat for lynx.

The LCAS (Reudiger et al. 2000) and the NRLMD (USDA Forest Service 2007) outlined criteria and related information when identifying LAUs and mapping lynx habitat. This process considered the following criteria and variables:

- Follow watershed boundaries, where appropriate;
- LAUs could encompass both potential lynx habitat (e.g., denning and foraging capable habitat) and non-lynx habitat (e.g., unsuitable areas such as lakes, low elevation ponderosa pine forest, and alpine tundra);
- The size of LAUs should generally be 25-50 mi² (15,000 to 25,000 acres) in size and likely larger in less contiguous or poor-quality habitat;
- Areas with small amounts of lynx habitat incapable of supporting a lynx home range (less than 6,400 acres) may be incorporated into neighboring LAUs or discarded or as lynx habitat if further than a day's travel distance for a lynx (3-6 miles) from the nearest neighboring LAU; and
- The distribution of habitat across the LAU should consider daily movement distances of resident females (typically up to 3-6 miles).

Process

The following method was used to update LAU delineations:

1. Initial LAU polygons were created by buffering lynx habitat by ¼ mile. This distance was used to optimize boundary smoothing while minimizing the inclusion of non-habitat areas.
2. The Forest then excluded areas that overlapped with existing LAUs on adjacent National Forest system lands. This resulted in a coincident boundary between the BDNF and other forest LAUs.
3. The resulting polygons were divided into LAUs using 6th code watershed boundary lines (HUC-12) to attain habitat acreage as close as possible to the suggested optimum range of 15,000-25,000 acres. Some LAUs fell outside of this range due to natural barriers, isolation, or other reasons; however, these LAUs were retained if minimum standards for lynx life history needs and spatial arrangement criteria were met. Per the LCAS, modeling should consider daily movement distances of resident females (3-6 miles) and should contain 6,400

acres of primary vegetation to support lynx (Reudiger et al. 2000). Areas with insignificant amounts of lynx habitat may be discarded (Ibid).

4. Polygons that did not meet minimum life history lynx standards or spatial arrangement criteria were re-classified as non-habitat and removed from further analysis. This included fragmented habitat consisting of areas further than 6 miles from other habitat and less than 6,400 acres of primary vegetation. Areas where habitat polygons did not meet delineation definitions (as described above) included: Bull Mountains (on-forest), southern Lima Tendoys (on-forest), Ruby Mountains (off-forest), and Rock Creek valley bottom (off-forest).
5. The resulting lynx habitat within delineated LAUs was calculated as:

- Primary vegetation habitat: 1,509,146 acres
- Secondary vegetation habitat: 116,660 acres
- Total lynx habitat: 1,625,806 acres

6. LAUs were assigned an alpha-numeric label in the form of "AA-NN", where "AA" is the forest plan landscape abbreviation code and "NN" is a sequential number, resulting in 78 individual LAUs containing lynx habitat ranging from 12,603 to 29,880 acres, with an average of 20,844 acres per LAU.

Structural Stage Classification

Rationale

Per the standards and guidelines in the NRLMD (USDA Forest Service 2007), the Forest classified lynx habitat (as identified in the *Lynx Habitat* section of this document) into five structural stages (Table 3). Although not part of the LCAS habitat mapping requirement, the Forest completed the exercise to assist with analysis at the project level.

Table 3. Lynx habitat structural stages per the Northern Rockies Lynx Management Direction (USDA Forest Service 2007).

Structural Stage	Definition	Model Parameters
Early stand initiation (ESI)	Stage that develops after a stand-replacing disturbance, such as fire, a regeneration harvest, or blowdown. A new single-story layer of shrubs and trees establish and develop. Trees are not tall enough to protrude above snow and stands are unsuitable for snowshoe hares in winter.	• Non-disturbed habitat stands that met ESI criteria based on the VMap crosswalk (Appendix A). • Disturbed habitat stands where: ○ Regeneration disturbance occurred in the last 20 years on NE, N, NW, and level aspects; or ○ Regeneration disturbance occurred in the last 30 years on E, SE, S, SW, W aspects.

Structural Stage	Definition	Model Parameters
Stand initiation (SI)	Stage that develops after a stand-replacing disturbance, such as fire, a regeneration harvest, or blowdown. A new single-story layer of shrubs and trees establish and develop. The trees are tall enough to protrude above snow and provide habitat for snowshoe hares in winter.	• Non-disturbed habitat stands that met SI criteria based on the VMap crosswalk (Appendix A). • Habitat stands where regeneration disturbance occurred: ○ within the last 21 to 40 years on NE, N, NW, and level aspects; or ○ within the last 31 to 40 years on E, SE, S, SW, W aspects.
Stem exclusion (SE)	This is a closed canopy stage. Trees initially grow fast and occupy all the growing space. Tall trees shade the forest floor so understory plants (including trees) grow more slowly.	• Non-disturbed habitat stands that met SE criteria based on the VMap crosswalk (Appendix A). • Habitat stands where regeneration disturbance occurred: ○ within in the last 41 to 80 years and VMap attributes are absent (i.e., "transitional forest"); or ○ within the last 41 to 80 years and VMAP attributes are present.
Mature; Multi-storied (MMS)	Many age classes and vegetation layers exist, including large, old trees and decaying trees.	• Non-disturbed habitat stands that met MMS criteria based on the VMap crosswalk (Appendix A). • Habitat stands where regeneration disturbance occurred: ○ more than 80 years ago and VMAP attributes are absent (i.e., "transitional forest"); or ○ more than 80 years ago and VMAP attributes are present.
Other (OT)	Any stand that does not fall into one of the above categories.	• Remaining stands of lynx habitat outside of the structural stages listed above.

Process

The Forest used the following method to assign structural stages to habitat:

1. Lynx habitat polygons without disturbances were assigned an initial classification based on VMap attributes. To complete this step, BDNF specialists created a "VMap to Structural Stage Crosswalk" (Appendix A). This crosswalk started with the Region 1 Eastside Forest Canada Lynx Habitat Mapping Model (USDA Forest Service 2016) which defined the default structural stage in polygons without disturbance. Specialists reviewed the crosswalk and polygons that did not fit the default regional model were modified based on local knowledge (BDNF modified structure).
2. Polygons that overlapped with disturbances were then reclassified based on the type and age of the disturbance. For this step, "disturbance" was defined by:

- FACTS database past activities with the following codes: 2400, 3350, 4101, 4102, 4110, 4111, 4113, 4115, 4116, 4117, 4121, 4122, 4123, 4131, 4132, 4133, 4134, 4141, 4142, 4143, 4145, 4146, 4147, 4148, 4151, 4152, 4162, 4175, 4176, 4177, 4183, 4192, 4193, 4194, 4196, 4231, 4240, 4242, 4270, 6104, 6130, or 6132;
- Past fires with a high, moderate, or an unknown burn intensity (where intensity was unknown, the entire fire perimeter was considered disturbance);
- Off-forest and non-Forest Service harvest activities, where known; or

- Other stand-replacing disturbances, where mapped, and age of disturbance is known or estimated.

3. Lynx habitat polygons were assigned a final structural stage using a decision tree (Figure 2). Note that there is a difference between *disturbance age* and *data age*, in that the age of disturbance will change every year. This process contains two assumptions: disturbance data are more accurate than VMap attribute values for disturbances less than forty years old and VMap values (not including “transitional forest”) are more accurate than disturbance data for disturbance areas greater than forty years old. Thus, if the age of disturbance is less than forty years old, disturbance data was used to determine the structure. If the age of disturbance is more than forty years old, VMap was used in areas where VMap attributes are other than “transitional forest”. If “transitional forest” is listed as an attribute, then disturbance data was used for a structural stage determination.

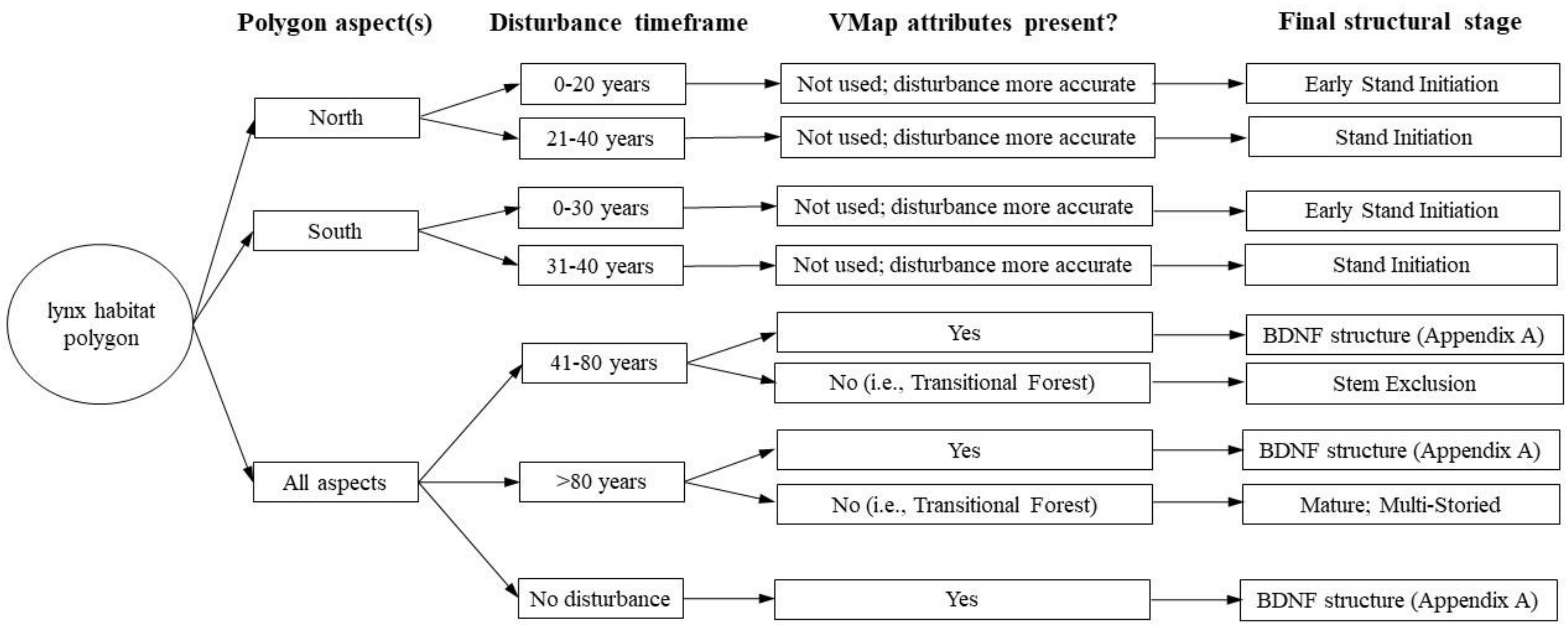

Figure 2. Process to assign a structural stage to lynx habitat polygons based on aspect, disturbance timeframe, and VMap attributes.

Habitat or Structural Stage Errors

In some cases, ground-verification reveals inaccurate habitat mapping or structural stage determinations. This generally occurs when field specialists verify the existing conditions within a project area prior to analysis. If mapped habitat or structural stage in the updated geospatial layer differs from existing on-the-ground conditions, updates will be made to the lynx habitat polygon or structural stage attributes to reflect the current conditions. Per guidance in the NRLMD, maps of lynx habitat would be reviewed and updated based on local information during site-specific project analysis (USDA Forest Service 2007).

Summary

The Beaverhead-Deerlodge National Forest updated lynx habitat, lynx analysis units, and assigned vegetation structural stages in 2020. This document describes the rationale, the methodology, and the data used to complete these updates. The current method utilizes the best available information to model and identify lynx habitat on the BDNF.

Current data indicates there is less mapped lynx habitat than previously estimated in 2000. In addition, fully delineating LAUs per mapping guidelines in the LCAS (Reudiger et al. 2000), the NRLMD (USDA Forest Service 2007), and the Regional Forester's Memo (Marten 2016) reduced the number and increased the size of LAUs. Table 4 reflects the changes from the previous mapping process in 2000 to the current mapping effort in 2020.

Table 4. Comparison of lynx habitat acres, number of lynx analysis units, and the range of habitat within lynx analysis units between mapping efforts.

Metric	2001 mapping effort	2020 mapping effort	Difference
Lynx habitat (acres)	2,711,422	1,625,806	-1,085,616
Lynx analysis units (number)	509	78	-431
Range of lynx habitat within LAUs (acres)	0-24,101	12,603 - 29,880	Minimum +12,603 Maximum +5,779

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Appendix A: VMap to Structural Stage Crosswalk.

Table A- 1. Crosswalk between VMap attributes and the resulting Forest modified structure based on local knowledge.

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	PIPO	0-4.9	25-39.9	all	Early Stand Initiation
TREE	PIPO	5-9.9	10-24.9	all	Other
TREE	PIPO	10-14.9	10-24.9	all	Other
TREE	PIPO	10-14.9	25-39.9	all	Other
TREE	PIPO	10-14.9	40-59.9	all	Other
TREE	PIPO	15-19.9	25-39.9	all	Other
TREE	PIPO-IMIX	5-9.9	10-24.9	all	Other
TREE	PIPO-IMIX	5-9.9	25-39.9	all	Other
TREE	PIPO-IMIX	10-14.9	10-24.9	all	Other
TREE	PIPO-IMIX	10-14.9	25-39.9	all	Other
TREE	PIPO-IMIX	15-19.9	10-24.9	all	Other
TREE	PIPO-IMIX	15-19.9	25-39.9	all	Other
TREE	PSME	0-4.9	10-24.9	all	Early Stand Initiation
TREE	PSME	0-4.9	25-39.9	all	Early Stand Initiation
TREE	PSME	0-4.9	40-59.9	all	Stand Initiation
TREE	PSME	0-4.9	≥ 60	all	Stand Initiation
TREE	PSME	5-9.9	10-24.9	all	Other
TREE	PSME	5-9.9	25-39.9	all	Other
TREE	PSME	5-9.9	40-59.9	all	Other
TREE	PSME	5-9.9	≥ 60	all	Stem Exclusion
TREE	PSME	10-14.9	10-24.9	all	Other
TREE	PSME	10-14.9	25-39.9	all	Other
TREE	PSME	10-14.9	40-59.9	all	Other

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	PSME	10-14.9	≥ 60	all	Other
TREE	PSME	15-19.9	10-24.9	all	Other
TREE	PSME	15-19.9	25-39.9	all	Other
TREE	PSME	15-19.9	40-59.9	all	Other
TREE	PSME	15-19.9	≥ 60	all	Other
TREE	PSME	≥ 20	10-24.9	all	Other
TREE	PSME	≥ 20	25-39.9	all	Other
TREE	PSME	≥ 20	40-59.9	all	Other
TREE	PSME	≥ 20	≥ 60	all	Other
TREE	PSME-IMIX	0-4.9	10-24.9	all	Early Stand Initiation
TREE	PSME-IMIX	0-4.9	25-39.9	all	Early Stand Initiation
TREE	PSME-IMIX	0-4.9	40-59.9	all	Stand Initiation
TREE	PSME-IMIX	0-4.9	≥ 60	all	Stand Initiation
TREE	PSME-IMIX	5-9.9	10-24.9	all	Other
TREE	PSME-IMIX	5-9.9	25-39.9	all	Other
TREE	PSME-IMIX	5-9.9	40-59.9	all	Other
TREE	PSME-IMIX	5-9.9	≥ 60	all	Other
TREE	PSME-IMIX	10-14.9	10-24.9	all	Other
TREE	PSME-IMIX	10-14.9	25-39.9	all	Other
TREE	PSME-IMIX	10-14.9	40-59.9	all	Other
TREE	PSME-IMIX	10-14.9	≥ 60	all	Other
TREE	PSME-IMIX	15-19.9	10-24.9	all	Other
TREE	PSME-IMIX	15-19.9	25-39.9	all	Other
TREE	PSME-IMIX	15-19.9	40-59.9	all	Other
TREE	PSME-IMIX	15-19.9	≥ 60	all	Other
TREE	PSME-IMIX	≥ 20	10-24.9	all	Other

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	PSME-IMIX	≥ 20	25-39.9	all	Other
TREE	PSME-IMIX	≥ 20	40-59.9	all	Other
TREE	PSME-IMIX	≥ 20	≥ 60	all	Other
TREE	PSME-TMIX	10-14.9	40-59.9	all	Mature; Multi-Storied
TREE	PSME-TMIX	10-14.9	≥ 60	all	Mature; Multi-Storied
TREE	PSME-TMIX	15-19.9	25-39.9	all	Mature; Multi-Storied
TREE	PSME-TMIX	15-19.9	40-59.9	all	Mature; Multi-Storied
TREE	PSME-TMIX	15-19.9	≥ 60	all	Mature; Multi-Storied
TREE	PSME-TMIX	≥ 20	25-39.9	all	Mature; Multi-Storied
TREE	PSME-TMIX	≥ 20	40-59.9	all	Mature; Multi-Storied
TREE	ABGR	5-9.9	40-59.9	all	Other
TREE	PICO	0-4.9	10-24.9	all	Early Stand Initiation
TREE	PICO	0-4.9	25-39.9	all	Early Stand Initiation
TREE	PICO	0-4.9	40-59.9	all	Stand Initiation
TREE	PICO	0-4.9	≥ 60	all	Stand Initiation
TREE	PICO	5-9.9	10-24.9	all	Other
TREE	PICO	5-9.9	25-39.9	all	Other
TREE	PICO	5-9.9	40-59.9	all	Other
TREE	PICO	5-9.9	≥ 60	all	Stem Exclusion
TREE	PICO	10-14.9	10-24.9	all	Other
TREE	PICO	10-14.9	25-39.9	all	Other
TREE	PICO	10-14.9	40-59.9	all	Stem Exclusion
TREE	PICO	10-14.9	≥ 60	all	Stem Exclusion
TREE	PICO	15-19.9	10-24.9	all	Other
TREE	PICO	15-19.9	25-39.9	all	Other
TREE	PICO	15-19.9	40-59.9	all	Stem Exclusion

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	PICO	15-19.9	≥ 60	all	Stem Exclusion
TREE	PICO	≥ 20	10-24.9	all	Other
TREE	PICO	≥ 20	25-39.9	all	Other
TREE	PICO	≥ 20	40-59.9	all	Stem Exclusion
TREE	PICO-IMIX	0-4.9	10-24.9	all	Early Stand Initiation
TREE	PICO-IMIX	0-4.9	25-39.9	all	Early Stand Initiation
TREE	PICO-IMIX	0-4.9	40-59.9	all	Stand Initiation
TREE	PICO-IMIX	0-4.9	≥ 60	all	Stand Initiation
TREE	PICO-IMIX	5-9.9	10-24.9	all	Other
TREE	PICO-IMIX	5-9.9	25-39.9	all	Other
TREE	PICO-IMIX	5-9.9	40-59.9	all	Other
TREE	PICO-IMIX	5-9.9	≥ 60	all	Other
TREE	PICO-IMIX	10-14.9	10-24.9	all	Other
TREE	PICO-IMIX	10-14.9	25-39.9	all	Other
TREE	PICO-IMIX	10-14.9	40-59.9	NW thru NE	Mature; Multi-Storied
TREE	PICO-IMIX	10-14.9	40-59.9	E thru W	Other
TREE	PICO-IMIX	10-14.9	≥ 60	NW thru NE	Mature; Multi-Storied
TREE	PICO-IMIX	10-14.9	≥ 60	E thru W	Other
TREE	PICO-IMIX	15-19.9	10-24.9	all	Other
TREE	PICO-IMIX	15-19.9	25-39.9	all	Other
TREE	PICO-IMIX	15-19.9	40-59.9	NW thru NE	Mature; Multi-Storied
TREE	PICO-IMIX	15-19.9	40-59.9	E thru W	Other
TREE	PICO-IMIX	15-19.9	≥ 60	NW thru NE	Mature; Multi-Storied
TREE	PICO-IMIX	15-19.9	≥ 60	E thru W	Other
TREE	PICO-IMIX	≥ 20	10-24.9	all	Other
TREE	PICO-IMIX	≥ 20	25-39.9	all	Other

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	PICO-IMIX	≥ 20	40-59.9	NW thru NE	Mature; Multi-Storied
TREE	PICO-IMIX	≥ 20	40-59.9	E thru W	Other
TREE	PICO-IMIX	≥ 20	≥ 60	NW thru NE	Mature; Multi-Storied
TREE	PICO-IMIX	≥ 20	≥ 60	E thru W	Other
TREE	PICO-TMIX	0-4.9	25-39.9	all	Early Stand Initiation
TREE	PICO-TMIX	0-4.9	40-59.9	all	Stand Initiation
TREE	PICO-TMIX	0-4.9	≥ 60	all	Stand Initiation
TREE	PICO-TMIX	5-9.9	10-24.9	all	Other
TREE	PICO-TMIX	5-9.9	25-39.9	all	Other
TREE	PICO-TMIX	5-9.9	40-59.9	all	Other
TREE	PICO-TMIX	5-9.9	≥ 60	all	Other
TREE	PICO-TMIX	10-14.9	10-24.9	all	Other
TREE	PICO-TMIX	10-14.9	25-39.9	all	Mature; Multi-Storied
TREE	PICO-TMIX	10-14.9	40-59.9	all	Mature; Multi-Storied
TREE	PICO-TMIX	10-14.9	≥ 60	all	Mature; Multi-Storied
TREE	PICO-TMIX	15-19.9	10-24.9	all	Other
TREE	PICO-TMIX	15-19.9	25-39.9	all	Mature; Multi-Storied
TREE	PICO-TMIX	15-19.9	40-59.9	all	Mature; Multi-Storied
TREE	PICO-TMIX	15-19.9	≥ 60	all	Mature; Multi-Storied
TREE	PICO-TMIX	≥ 20	25-39.9	all	Mature; Multi-Storied
TREE	PICO-TMIX	≥ 20	40-59.9	all	Mature; Multi-Storied
TREE	PICO-TMIX	≥ 20	≥ 60	all	Mature; Multi-Storied
TREE	ABLA	0-4.9	10-24.9	all	Early Stand Initiation
TREE	ABLA	0-4.9	25-39.9	all	Early Stand Initiation
TREE	ABLA	5-9.9	10-24.9	all	Other
TREE	ABLA	5-9.9	25-39.9	all	Other

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	ABLA	5-9.9	40-59.9	all	Other
TREE	ABLA	5-9.9	≥ 60	all	Other
TREE	ABLA	10-14.9	10-24.9	all	Other
TREE	ABLA	10-14.9	25-39.9	all	Other
TREE	ABLA	10-14.9	40-59.9	all	Mature; Multi-Storied
TREE	ABLA	10-14.9	≥ 60	all	Mature; Multi-Storied
TREE	ABLA	15-19.9	10-24.9	all	Other
TREE	ABLA	15-19.9	25-39.9	all	Other
TREE	ABLA	15-19.9	40-59.9	all	Mature; Multi-Storied
TREE	ABLA	≥ 20	25-39.9	all	Other
TREE	ABLA	≥ 20	40-59.9	all	Mature; Multi-Storied
TREE	ABLA-IMIX	0-4.9	10-24.9	all	Early Stand Initiation
TREE	ABLA-IMIX	0-4.9	40-59.9	all	Stand Initiation
TREE	ABLA-IMIX	5-9.9	10-24.9	all	Other
TREE	ABLA-IMIX	5-9.9	25-39.9	all	Other
TREE	ABLA-IMIX	5-9.9	40-59.9	all	Other
TREE	ABLA-IMIX	5-9.9	≥ 60	all	Other
TREE	ABLA-IMIX	10-14.9	10-24.9	all	Other
TREE	ABLA-IMIX	10-14.9	25-39.9	all	Other
TREE	ABLA-IMIX	10-14.9	40-59.9	all	Mature; Multi-Storied
TREE	ABLA-IMIX	10-14.9	≥ 60	all	Mature; Multi-Storied
TREE	ABLA-IMIX	15-19.9	10-24.9	all	Other
TREE	ABLA-IMIX	15-19.9	25-39.9	all	Other
TREE	ABLA-IMIX	15-19.9	40-59.9	all	Mature; Multi-Storied
TREE	ABLA-IMIX	15-19.9	≥ 60	all	Mature; Multi-Storied
TREE	ABLA-IMIX	≥ 20	25-39.9	all	Other

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	ABLA-IMIX	≥ 20	40-59.9	all	Mature; Multi-Storied
TREE	ABLA-TMIX	0-4.9	10-24.9	all	Early Stand Initiation
TREE	ABLA-TMIX	0-4.9	25-39.9	all	Early Stand Initiation
TREE	ABLA-TMIX	5-9.9	10-24.9	all	Other
TREE	ABLA-TMIX	5-9.9	25-39.9	all	Other
TREE	ABLA-TMIX	5-9.9	40-59.9	all	Other
TREE	ABLA-TMIX	5-9.9	≥ 60	all	Other
TREE	ABLA-TMIX	10-14.9	10-24.9	all	Other
TREE	ABLA-TMIX	10-14.9	25-39.9	all	Mature; Multi-Storied
TREE	ABLA-TMIX	10-14.9	40-59.9	all	Mature; Multi-Storied
TREE	ABLA-TMIX	10-14.9	≥ 60	all	Mature; Multi-Storied
TREE	ABLA-TMIX	15-19.9	10-24.9	all	Other
TREE	ABLA-TMIX	15-19.9	25-39.9	all	Mature; Multi-Storied
TREE	ABLA-TMIX	15-19.9	40-59.9	all	Mature; Multi-Storied
TREE	ABLA-TMIX	15-19.9	≥ 60	all	Mature; Multi-Storied
TREE	ABLA-TMIX	≥ 20	25-39.9	all	Mature; Multi-Storied
TREE	ABLA-TMIX	≥ 20	40-59.9	all	Mature; Multi-Storied
TREE	PIEN	0-4.9	10-24.9	all	Early Stand Initiation
TREE	PIEN	0-4.9	25-39.9	all	Early Stand Initiation
TREE	PIEN	0-4.9	40-59.9	all	Stand Initiation
TREE	PIEN	0-4.9	≥ 60	all	Stand Initiation
TREE	PIEN	5-9.9	10-24.9	all	Other
TREE	PIEN	5-9.9	25-39.9	all	Other
TREE	PIEN	5-9.9	40-59.9	all	Other
TREE	PIEN	5-9.9	≥ 60	all	Other
TREE	PIEN	10-14.9	10-24.9	all	Other

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	PIAL	10-14.9	25-39.9	all	Other
TREE	PIAL	10-14.9	40-59.9	all	Other
TREE	PIAL	10-14.9	≥ 60	all	Other
TREE	PIAL	15-19.9	10-24.9	all	Other
TREE	PIAL	15-19.9	25-39.9	all	Other
TREE	PIAL	15-19.9	40-59.9	all	Other
TREE	PIAL	15-19.9	≥ 60	all	Other
TREE	PIAL	≥ 20	10-24.9	all	Other
TREE	PIAL	≥ 20	25-39.9	all	Other
TREE	PIAL	≥ 20	40-59.9	all	Other
TREE	PIAL-IMIX	0-4.9	10-24.9	all	Early Stand Initiation
TREE	PIAL-IMIX	0-4.9	25-39.9	all	Early Stand Initiation
TREE	PIAL-IMIX	0-4.9	40-59.9	all	Stand Initiation
TREE	PIAL-IMIX	0-4.9	≥ 60	all	Stand Initiation
TREE	PIAL-IMIX	5-9.9	10-24.9	all	Other
TREE	PIAL-IMIX	5-9.9	25-39.9	all	Other
TREE	PIAL-IMIX	5-9.9	40-59.9	all	Other
TREE	PIAL-IMIX	5-9.9	≥ 60	all	Other
TREE	PIAL-IMIX	10-14.9	10-24.9	all	Other
TREE	PIAL-IMIX	10-14.9	25-39.9	all	Other
TREE	PIAL-IMIX	10-14.9	40-59.9	all	Mature; Multi-Storied
TREE	PIAL-IMIX	10-14.9	≥ 60	all	Mature; Multi-Storied
TREE	PIAL-IMIX	15-19.9	10-24.9	all	Other
TREE	PIAL-IMIX	15-19.9	25-39.9	all	Other
TREE	PIAL-IMIX	15-19.9	40-59.9	all	Mature; Multi-Storied
TREE	PIAL-IMIX	15-19.9	≥ 60	all	Mature; Multi-Storied

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	PIAL-IMIX	≥ 20	10-24.9	all	Other
TREE	PIAL-IMIX	≥ 20	25-39.9	all	Other
TREE	PIAL-IMIX	≥ 20	40-59.9	all	Mature; Multi-Storied
TREE	PIAL-TMIX	5-9.9	10-24.9	all	Other
TREE	PIAL-TMIX	5-9.9	25-39.9	all	Other
TREE	PIAL-TMIX	5-9.9	40-59.9	all	Other
TREE	PIAL-TMIX	5-9.9	≥ 60	all	Other
TREE	PIAL-TMIX	10-14.9	10-24.9	all	Other
TREE	PIAL-TMIX	10-14.9	25-39.9	all	Mature; Multi-Storied
TREE	PIAL-TMIX	10-14.9	40-59.9	all	Mature; Multi-Storied
TREE	PIAL-TMIX	10-14.9	≥ 60	all	Mature; Multi-Storied
TREE	PIAL-TMIX	15-19.9	10-24.9	all	Other
TREE	PIAL-TMIX	15-19.9	25-39.9	all	Mature; Multi-Storied
TREE	PIAL-TMIX	15-19.9	40-59.9	all	Mature; Multi-Storied
TREE	PIAL-TMIX	15-19.9	≥ 60	all	Mature; Multi-Storied
TREE	PIAL-TMIX	≥ 20	10-24.9	all	Other
TREE	PIAL-TMIX	≥ 20	25-39.9	all	Mature; Multi-Storied
TREE	PIAL-TMIX	≥ 20	40-59.9	all	Mature; Multi-Storied
TREE	PIFL2	0-4.9	10-24.9	all	Early Stand Initiation
TREE	PIFL2	0-4.9	25-39.9	all	Early Stand Initiation
TREE	PIFL2	5-9.9	10-24.9	all	Other
TREE	PIFL2	5-9.9	25-39.9	all	Other
TREE	PIFL2	5-9.9	40-59.9	all	Other
TREE	PIFL2	10-14.9	10-24.9	all	Other
TREE	PIFL2	10-14.9	25-39.9	all	Other
TREE	PIFL2	10-14.9	40-59.9	all	Other

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	PIFL2	15-19.9	10-24.9	all	Other
TREE	PIFL2	15-19.9	25-39.9	all	Other
TREE	PIFL2	15-19.9	40-59.9	all	Other
TREE	PIFL2	≥ 20	25-39.9	all	Other
TREE	PIFL2-IMIX	0-4.9	10-24.9	all	Early Stand Initiation
TREE	PIFL2-IMIX	0-4.9	25-39.9	all	Early Stand Initiation
TREE	PIFL2-IMIX	0-4.9	40-59.9	all	Early Stand Initiation
TREE	PIFL2-IMIX	5-9.9	10-24.9	all	Other
TREE	PIFL2-IMIX	5-9.9	25-39.9	all	Other
TREE	PIFL2-IMIX	5-9.9	40-59.9	all	Other
TREE	PIFL2-IMIX	5-9.9	≥ 60	all	Other
TREE	PIFL2-IMIX	10-14.9	10-24.9	all	Other
TREE	PIFL2-IMIX	10-14.9	25-39.9	all	Other
TREE	PIFL2-IMIX	10-14.9	40-59.9	all	Other
TREE	PIFL2-IMIX	10-14.9	≥ 60	all	Other
TREE	PIFL2-IMIX	15-19.9	10-24.9	all	Other
TREE	PIFL2-IMIX	15-19.9	25-39.9	all	Other
TREE	PIFL2-IMIX	15-19.9	40-59.9	all	Other
TREE	PIFL2-TMIX	5-9.9	10-24.9	all	Other
TREE	PIFL2-TMIX	10-14.9	10-24.9	all	Other
TREE	PIFL2-TMIX	10-14.9	40-59.9	all	Other
TREE	PIFL2-TMIX	15-19.9	25-39.9	all	Other
TREE	JUNIP	0-4.9	10-24.9	all	Early Stand Initiation
TREE	JUNIP	5-9.9	10-24.9	all	Other
TREE	JUNIP	10-14.9	10-24.9	all	Other
TREE	JUNIP	15-19.9	10-24.9	all	Other

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	IMIX	0-4.9	10-24.9	all	Early Stand Initiation
TREE	IMIX	0-4.9	25-39.9	all	Early Stand Initiation
TREE	IMIX	0-4.9	40-59.9	all	Stand Initiation
TREE	IMIX	0-4.9	≥ 60	all	Stand Initiation
TREE	IMIX	5-9.9	10-24.9	all	Other
TREE	IMIX	5-9.9	25-39.9	all	Other
TREE	IMIX	5-9.9	40-59.9	all	Other
TREE	IMIX	5-9.9	≥ 60	all	Other
TREE	IMIX	10-14.9	10-24.9	all	Other
TREE	IMIX	10-14.9	25-39.9	all	Other
TREE	IMIX	10-14.9	40-59.9	NW thru NE	Mature; Multi-Storied
TREE	IMIX	10-14.9	40-59.9	E thru W	Other
TREE	IMIX	10-14.9	≥ 60	NW thru NE	Mature; Multi-Storied
TREE	IMIX	10-14.9	≥ 60	E thru W	Other
TREE	IMIX	15-19.9	10-24.9	all	Other
TREE	IMIX	15-19.9	25-39.9	all	Other
TREE	IMIX	15-19.9	40-59.9	NW thru NE	Mature; Multi-Storied
TREE	IMIX	15-19.9	40-59.9	E thru W	Other
TREE	IMIX	15-19.9	≥ 60	NW thru NE	Mature; Multi-Storied
TREE	IMIX	15-19.9	≥ 60	E thru W	Other
TREE	IMIX	≥ 20	10-24.9	all	Other
TREE	IMIX	≥ 20	25-39.9	all	Other
TREE	IMIX	≥ 20	40-59.9	NW thru NE	Mature; Multi-Storied
TREE	IMIX	≥ 20	40-59.9	E thru W	Other
TREE	IMIX	≥ 20	≥ 60	NW thru NE	Mature; Multi-Storied
TREE	IMIX	≥ 20	≥ 60	E thru W	Other

Life form	VMap dominance group 6040 attribute	Tree size (diameter at breast height; inches)	Tree canopy cover (percent)	Aspect	BDNF modified structure
TREE	TMIX	0-4.9	10-24.9	all	Early Stand Initiation
TREE	TMIX	0-4.9	25-39.9	all	Early Stand Initiation
TREE	TMIX	0-4.9	40-59.9	all	Stand Initiation
TREE	TMIX	0-4.9	≥ 60	all	Stand Initiation
TREE	TMIX	5-9.9	10-24.9	all	Other
TREE	TMIX	5-9.9	25-39.9	all	Other
TREE	TMIX	5-9.9	40-59.9	all	Other
TREE	TMIX	5-9.9	≥ 60	all	Other
TREE	TMIX	10-14.9	10-24.9	all	Other
TREE	TMIX	10-14.9	25-39.9	all	Mature; Multi-Storied
TREE	TMIX	10-14.9	40-59.9	all	Mature; Multi-Storied
TREE	TMIX	10-14.9	≥ 60	all	Mature; Multi-Storied
TREE	TMIX	15-19.9	10-24.9	all	Other
TREE	TMIX	15-19.9	25-39.9	all	Mature; Multi-Storied
TREE	TMIX	15-19.9	40-59.9	all	Mature; Multi-Storied
TREE	TMIX	15-19.9	≥ 60	all	Mature; Multi-Storied
TREE	TMIX	≥ 20	10-24.9	all	Other
TREE	TMIX	≥ 20	25-39.9	all	Mature; Multi-Storied
TREE	TMIX	≥ 20	40-59.9	all	Mature; Multi-Storied
TREE	TMIX	≥ 20	≥ 60	all	Mature; Multi-Storied
TREE-DECID	POPUL	Not applicable	Not applicable	all	Other
TREE-DECID	POTR5	Not applicable	Not applicable	all	Other
SHRUB, HERB, OR SPVG (if no disturbance layer overlaps)	Not applicable	Not applicable	Not applicable	Not applicable	Early Stand Initiation
VMAP 'TRANSITIONAL FOREST' (if no disturbance layer overlaps)	Not applicable	Not applicable	Not applicable	Not applicable	Early Stand Initiation

Appendix B: Lynx habitat and lynx analysis unit maps on the Beaverhead-Deerlodge National Forest.

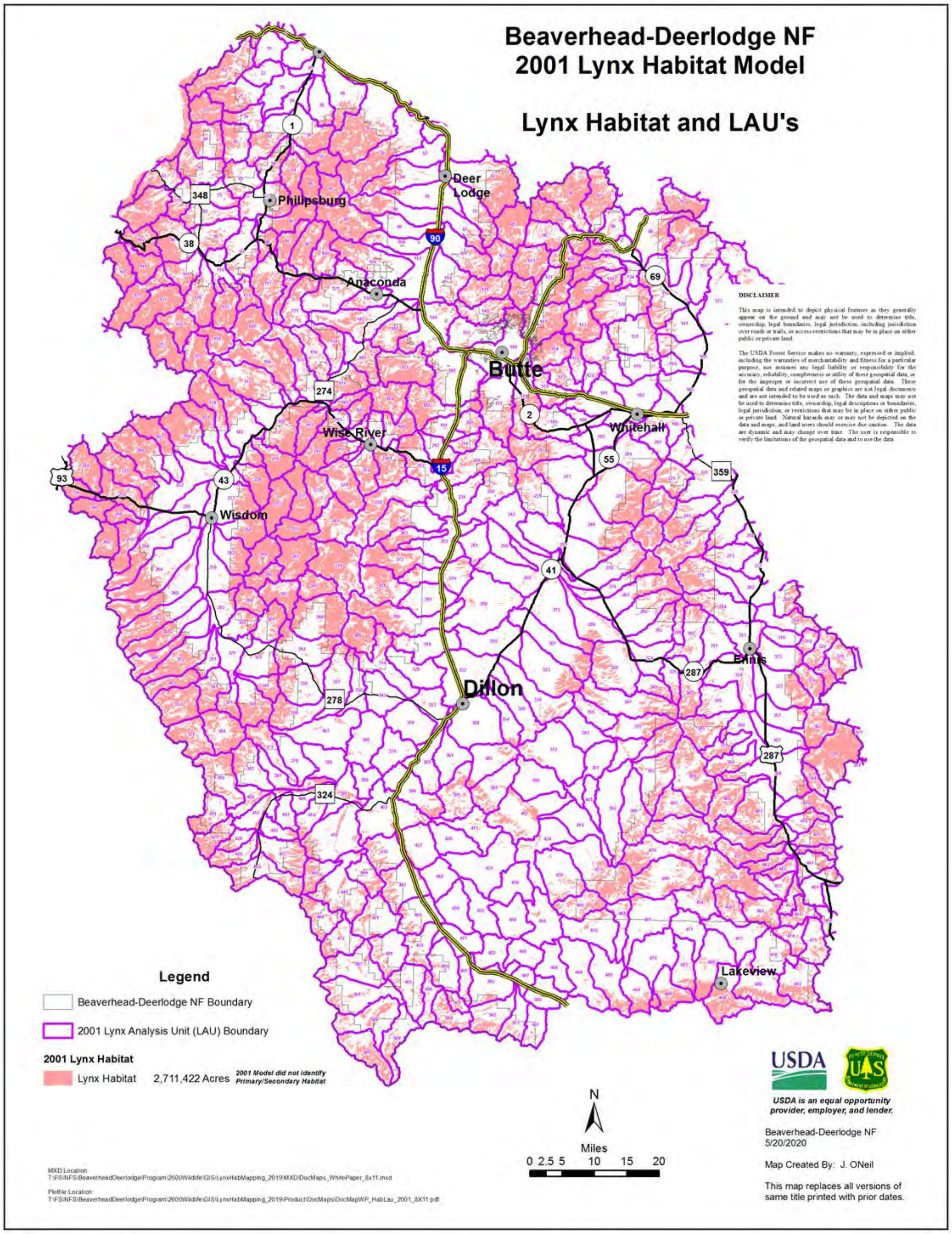

Figure B- 1. 2001 lynx habitat and lynx analysis units on the Beaverhead-Deerlodge National Forest.

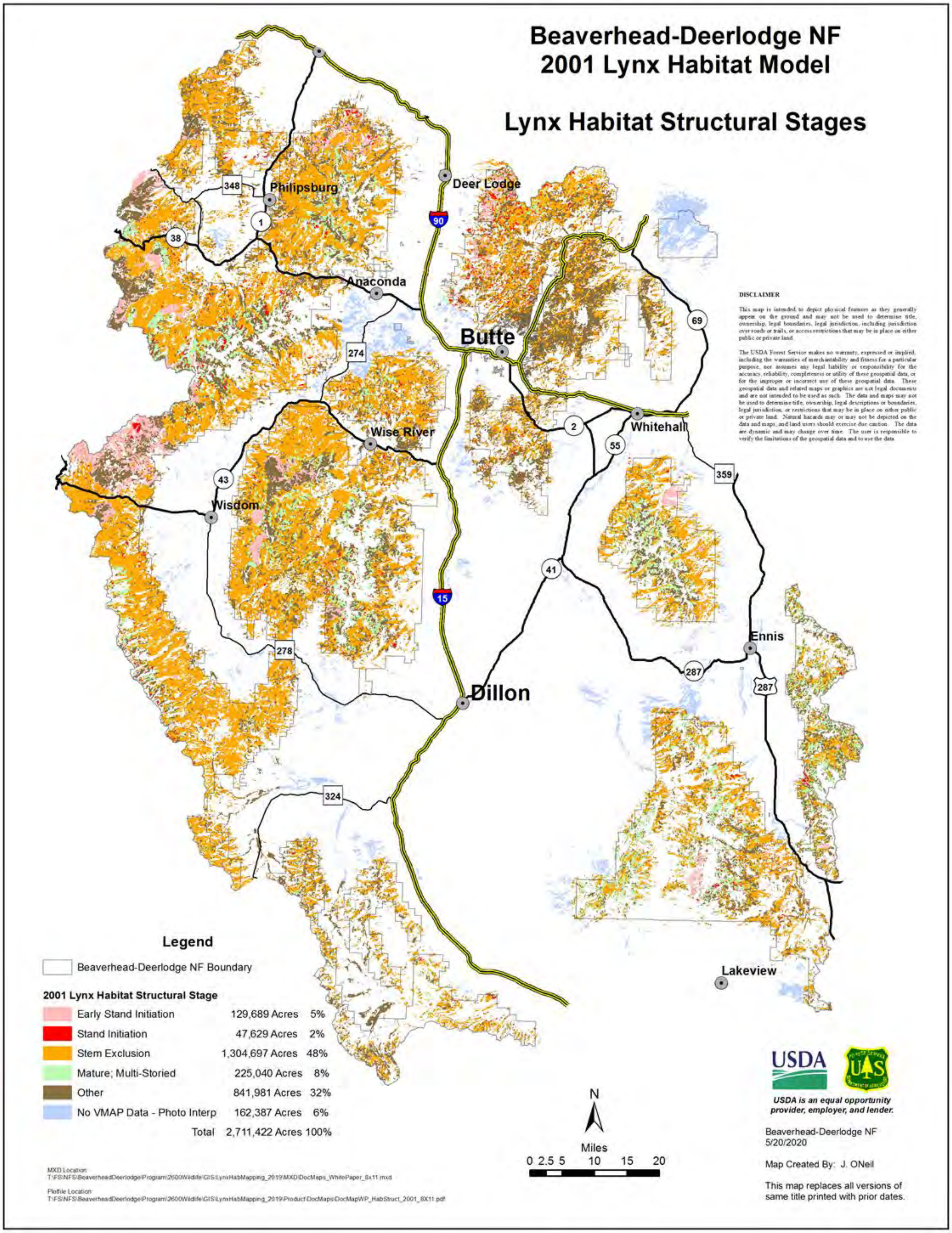

Figure B- 2. Vegetation structural stages within 2001 lynx habitat on the Beaverhead-Deerlodge National Forest.

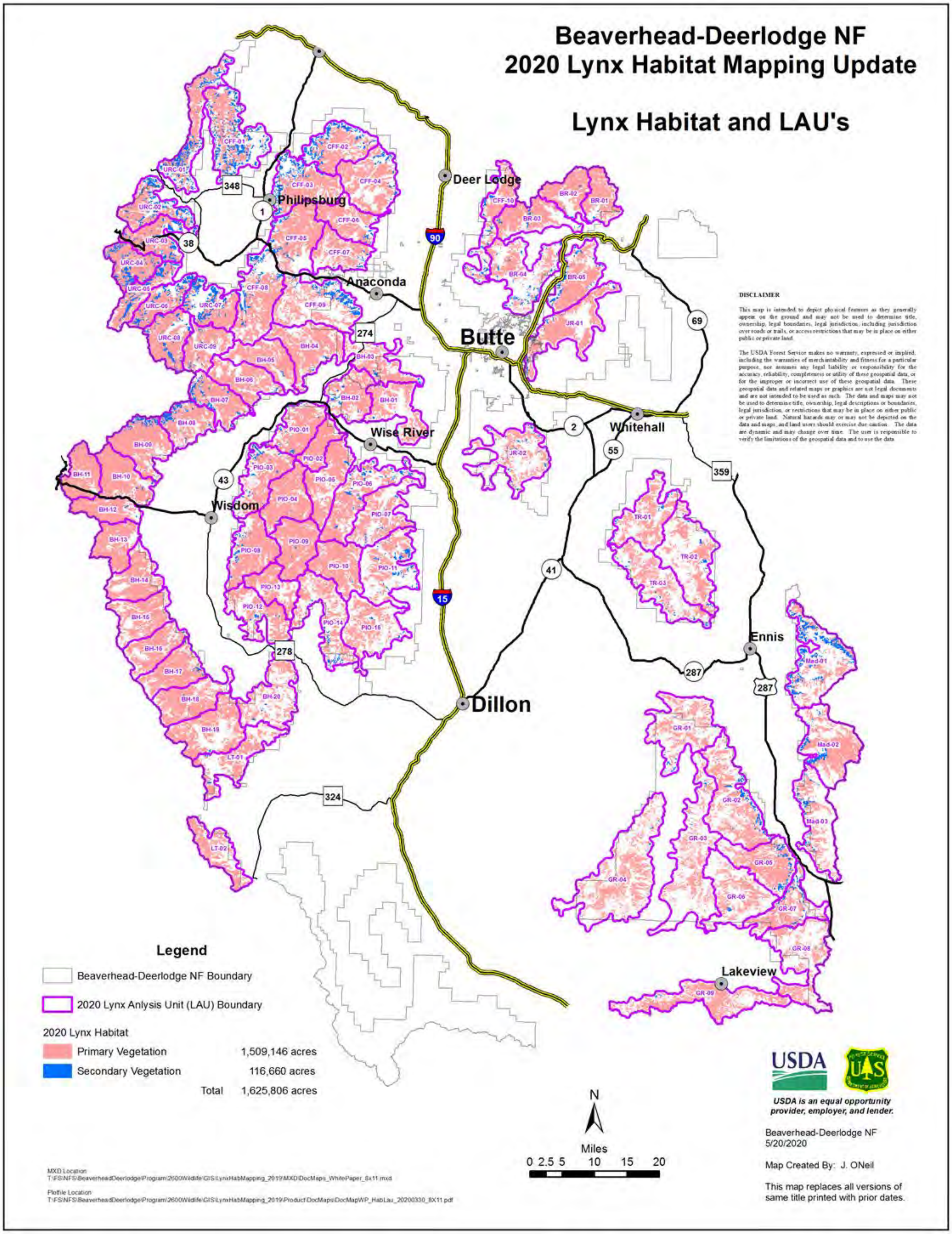

Figure B- 3. 2020 lynx habitat and lynx analysis units on the Beaverhead-Deerlodge National Forest.

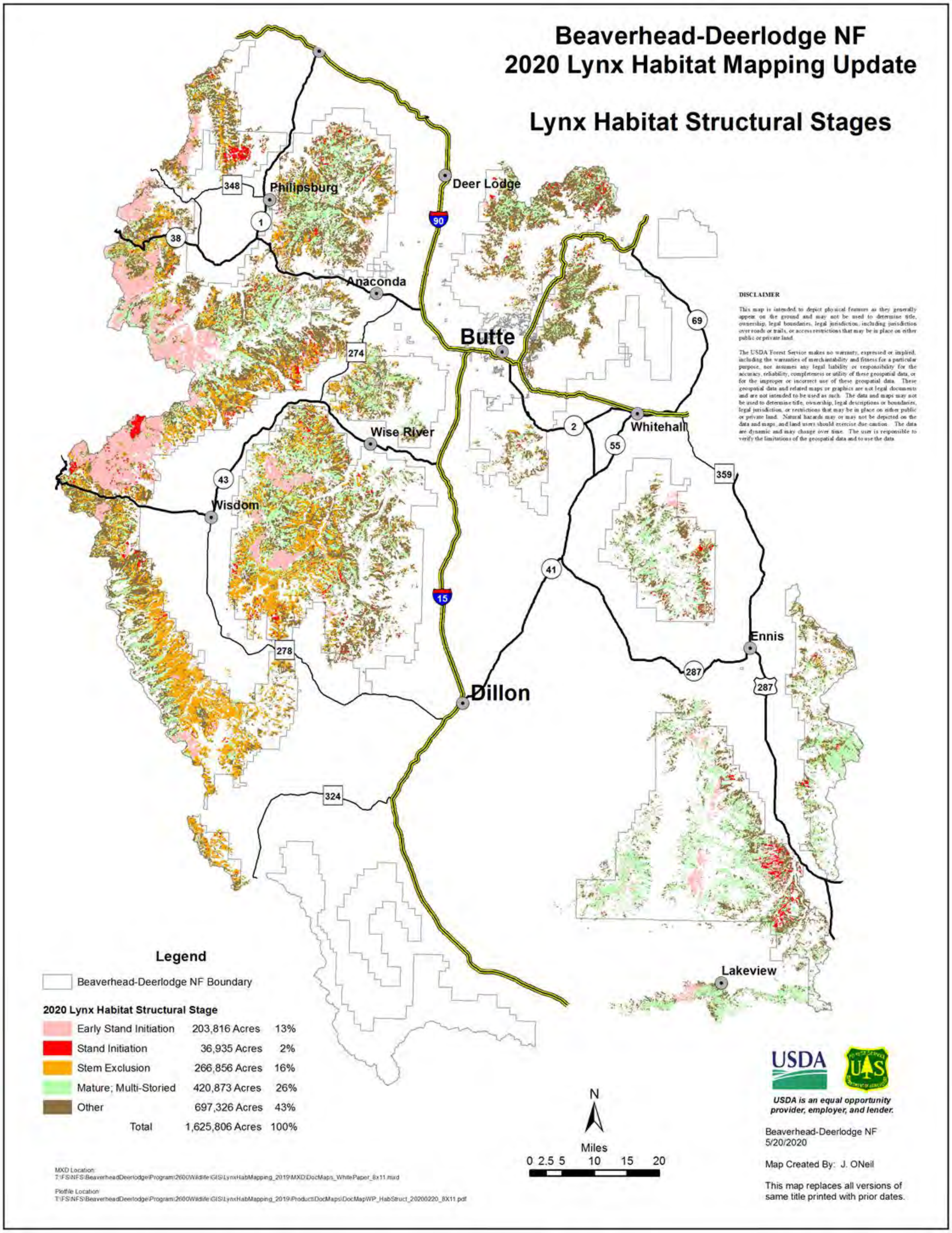

Figure B- 4. Vegetation structural stages within 2020 lynx habitat on the Beaverhead-Deerlodge National Forest.

Appendix D: Justification for exception and exemption acres.

Although not required, the Forest consolidated a list of projects since 2009 (the start of the revised Forest Plan) that used exception and exemption acres to meet the intent of the NRLMD. To date, the Forest has exceeded these exceptions for the research and aspen categories in VEG S5 and the research and salvage categories in VEG S6, which now apply due to the occupancy change (Table D- 1). Justifications are provided for those categories where exceptions or exemptions are requested.

It is important to note that tracking exceptions and exemptions are not considered "take" as the BDNF was not required to follow the NRLMD prior to the chance in occupancy. To meet the intent of the NRLMD, claimed exception and exemption acres were determined by identifying completed projects and those with signed decisions, but have not yet been implemented. With the change in occupancy, the BDNF will track exception and exemption acres for all future projects.

Exemption acres under VEG S5 and VEG S6 for WUI apply across the category, meaning a maximum of 88,910 acres, can apply to either VEG S5 or VEG S6 as long as the total number of acres is not exceeded.

Similarly, the total of 6,200 acres for VEG S5 and 290 acres for VEG S6 can apply to any of the subcategories within these standards, as long as the total amount is not exceeded. Subcategories are disclosed in Table D-1 to provide a clear justification for the requested change.

Table D- 1: Exception and exemption acres claimed under the previous lynx habitat model and requested acres using the 2020 updated habitat.

Exception/Exemption Category	Identified exception or exemption acres[a]	Claimed exception or exemption acres[b]	Balance between identified and claimed acres	Requested exception or exemption acres
VEG S5 (#1)– within 200 feet of administrative sites	0	0	0	250
VEG S5 (#2) – research or genetic test	40	303	-263	500
VEG S5 (#4)– aspen	220	243	-27	5,250
VEG S5 (#5)– western white pine	0	0	0	0
VEG S5 (#6)– whitebark pine	0	0	0	200
VEG S5 – WUI – 6% of mapped lynx habitat within an administrative boundary (SI)[c]	154,400	49	154,351	88,910
VEG S6 (#1) – within 200 feet of administrative sites[c]	0	0	0	250
VEG S6 (#2) – research	0	10	-10	40
VEG S6 (#3) – salvage	0	43	-43	100
VEG S6 - WUI – 6% of mapped lynx habitat within an administrative boundary (MMS)[d]	154,400	317	154,083	88,910

[a]Identified area acres as determined by guidance in the NRLMD (USDA 2007b) and outlined in the 2007 Biological Assessment (Bertram 2007).

[b]Claimed exception acres include all implemented projects and those with a signed decision BDNF projects from 2009-present. 2009 was used as a reasonable timeframe as the revised Forest Plan was completed and signed.

[c]Exemption acres for WUI were assigned by grouping VEG S5 and VEG S6 categories, thus repeated numbers indicate a total across a category, not a sum (154,400 acres is the total for both VEG S5 and VEG S6 WUI categories).

Assumptions

1. The frequency of treatment around administrative sites to create and maintain defensible space varies and development of new sites is likely within the life of the Forest Plan.
2. The Forest will likely receive increased timber and fuels targets within the next 15 years, indicated by direction from the Regional Office.
3. Numbers in this justification represent a likely scenario given increased timber and fuels targets for the Forest and the history of acres utilized within each category since 2009.

VEG S5 #1 and VEG S6 #1 – within 200 feet of administrative sites

Activities that would utilize these exception acres include creating defensible space around administrative sites, including but not limited to developed recreation facilities (campgrounds, day use areas, etc.), infrastructure (buildings, communication towers, etc.), and dwellings. The BDNF did not have any exception acres in this category in the original NRLMD analysis. However, vegetation removal around administrative sites to create defensible space is an important consideration for the societal and economic values on the BDNF. There are approximately 275 developed recreation sites on the BDNF, including those under a special use permit. If all of these sites required defensible space treatments, a total of 795 acres could be affected. This number does not include other infrastructure that may require defensible space treatments, such as communication towers or other buildings. It is extremely unlikely all administrative sites would require defensible space treatment and also intersect with lynx habitat, but it is possible that some lynx habitat could be affected within the next fifteen years. Sites may also vary with the frequency of treatment to maintain defensible space. Given the estimated number of developed recreation sites on the BDNF, other infrastructure, and the potential to add more administrative sites in the future that may require maintenance of defensible space (e.g., additional communication towers), 500 acres is a reasonable estimate for vegetation removal in stand initiation and mature, multi-storied structural stages for the purpose of creating and maintaining defensible space. This represents less than one percent of available foraging habitat for lynx on lands administered by the BDNF. 250 acres (for a total of 500 acres) is attributed to using either VEG S5 or VEG S6 to maintain administrative sites.

VEG S5 #2 – research or genetic test

In general, activities that utilize these exception acres include liberating individual tree species of interest in early seral stands to create ecological conditions to promote or enhance existing trees, which may remove snowshoe hare habitat. Three projects utilized a total of 303 acres in this category since 2009. Since only 3 projects occurred in the previous 11 years, it is reasonable to assume an additional 2-4 projects consisting of 4,000-5,000 total acres apiece could occur within the next 15 years due to the increased pace and scale of the timber program (A. Brennick, pers. comm., 6 October 2020). However, only a small portion of these projects is likely to require the use of this category and would only occur where absolutely necessary to meet project objectives. Since the Forest "exceeded" this category by 303 acres, a reasonable estimation is 500 acres given the increase emphasis on the timber program over the next 15 years. If the estimated number of acres are treated for research or genetic testing (8,000 - 20,000 acres, or 2-4 projects of 4,000-5,000 acres each), the percentage of these projects utilizing this exception category ranges from 2.5 to 6.25 percent of the project area. Under the updated lynx habitat model, 36,935 acres are currently in the stand initiation phase, although only 36,023 acres are under BDNF management. 500 acres under this exception equates to 1.4 percent of the available habitat within this structural stage across all modeled LAUs and lands under BDNF management.

VEG S5 #4 – aspen

Since 2009, the Forest has utilized a total of 243 acres of the aspen exception acres under Vegetation Standard 5 (#4). This exception applies to precommercial thinning treatments in young stands. This exceeds the 220 acres as identified by the NRLMD. At the current rate, the Forest utilized around 22 acres per year in the aspen exception. With the increased pace of aspen restoration, it is possible the Forest could utilize up to 350 acres per year over the next 15 years compared to the 22 acres per year treated over the last decade (B. Anderson, pers. comm., 13 October 2020). This increase represents a total of 5,250 acres in the Vegetation Standard 5 (#4) category. If the maximum acres of aspen are treated within the next 15 years (52,500 acres), exception acres represent approximately 8 percent of the Forest Plan aspen goal (67,000 acres). Because aspen lacks its own cover type category in VMAP 18, it is not possible to project the percentage of aspen that consist of exception acres compared to total acres of aspen on the BDNF. However, 36,935 acres are currently in the stand initiation phase across modeled LAUs, although only 36,023 acres are under BDNF ownership. 5,250 acres under this exception represents approximately 7 percent of the total acres in the stand initiation phase across LAUs and under BDNF management.

VEG S5 #6 – whitebark pine

Although the BDNF has not utilized this category in the past, future actions could treat snowshoe hare habitat for the purposes of improving or restoring whitebark pine. Currently, 2 percent (28,673 acres) of lynx habitat consists of whitebark pine (Table 6). Of this habitat, 10,438 acres are either suitable for timber production or harvest is allowed for other activities (Table 8). There are currently 124 acres of whitebark pine within the stand initiation structural stage where harvest could occur (ibid). Given estimates in increased timber and potential growth of other stands, a reasonable assumption for improving or restoring whitebark pine stands is 200 acres. This represents less than one percent of the available lynx habitat that consists of whitebark pine habitat on the BDNF.

VEG S6 #2 – research

Similar to the previous category, activities that utilize exception acres under VEG S6 (research) aim to liberate individual tree species of interest in mature, multi-story or late successional forests, which may reduce snowshoe hare habitat. Since 2009, a single 30-acre project used this exception, although only 10 acres (33 percent) consisted of habitat that met this category. Given similar estimations of likely increases in timber, a reasonable assumption for this category is 40 acres (A. Brennick, pers. comm., 6 October 2020). Within all LAUs, a total of 420,873 acres consists of mature, multi-storied habitat, although only 382,777 acres is under BDNF ownership. Forty acres in this exception represents less a percent of the available mature, multi-storied lynx habitat in both LAUs and lands under BDNF management.

VEG S6 #3 – salvage

Salvage activities include the removal of dead and dying timber. In general, treatments under salvage occurs in stands impacted by beetle kill, fires, or other environmental factors or events that cause a decrease in timber value. Stands must be harvested prior to losing all marketable value.

This exception allows for incidental removal (such as skid trail construction) of snowshoe hare habitat in mature, multi-story or late successional stands during a salvage treatment. Since 2009, a single 725-acre project utilized 43 acres under this exception, which equates to 6 percent of the project area. Given the number of existing stands affected by insects and disease and the possibility of increased fires, 100 acres in this category for the next 15 years is a reasonable estimation. Within all LAUs, a total of 420,873 acres consists of mature, multi-storied habitat, although only 382,777 acres is under BDNF management. One

hundred acres in this exception represents less than a percent of the available mature, multi-storied lynx habitat in both LAUs and lands under BDNF management.

VEG S5 and VEG S6 WUI - 6% of mapped lynx habitat within an administrative boundary

Both Vegetation Standards 5 and 6 have direction that applies to fuels treatment projects within the WUI that do not meet Vegetation Standards S1, S2, S5, and S6. These projects shall occur on no more than 6 percent (cumulatively) of lynx habitat on each Forest as a whole. In addition, fuels treatments may not result in more than three adjacent LAUs exceeding the standards. The NRLMD combines the exception acres in VEG S5 and VEG S6 and set the limit for the BDNF at 154,400 acres. Since 2009, the BDNF treated 49 acres of stand initiation and 317 acres of mature, multi-storied lynx habitat in the WUI. This equates to less than 1 percent of the available exemption acres for this category.

Lynx habitat under Forest management (excluding inholdings) was used as the basis for calculating the six percent ceiling. Under the updated habitat model, this limits WUI treatments to 88,910 acres of lynx habitat. This represents a 58 percent decrease of exemption acres for these categories.

Projects contributing to exception and exemption acres

Table D- 2 contains the list of projects from 2009 to present that contributed to the calculation of claimed exemption acres.

Table D- 2: Completed, ongoing, and signed projects that contributed to exception and exemption acre calculations under the previous lynx habitat model.

Project	Year	Exception/exemptions(s) Utilized	Acres
Completed projects			
Barker Lakes	2011	VEG S5 #2	75
Meadow Creek Fuels	2011	VEG S6 WUI	283
Crockett Lake	2014	VEG S6 #2	10
Roadside 8	2015	VEG S6 #3	43
Mussigbrod	2015	VEG S5 #2	200
Boulder Lowlands	2015	VEG 65 WUI	15
Aspen CE - Shineberger	2017	VEG S5 #4	3
Aspen CE – Mount Haggin	2018	VEG S5 #4	13
Ongoing projects			
Highlands Whitebark Pine Research	2013	VEG S5 #2	28
Trapper Creek	2014	VEG S5 #4	19
East Deerlodge Valley Landscape Restoration Management Project	2015	VEG S5 #4	38
Blacktail Headwaters	2015	VEG S5 #4 VEG S5 WUI VEG S6 WUI	112 49 19
Aspen CE- Birch, Willow, Lost	2017	VEG S5 #4	3
Aspen CE – Deadwood	2018	VEG S5 #4	9
Red Rocks Vegetation Management Project	2019	VEG S5 #4	65
Signed projects – not implemented			

Project	Year	Exception/exemptions(s) Utilized	Acres
Fleecer	2018	VEG S5 #4	49